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# First order phase transitions in nonlinear vector and lattice gauge models.(Applications of Renormalization Group Methods in Mathematical Sciences)

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## First order phase transitions in nonlinear vector and lattice gauge models.

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### Abstract

In this contribution we discuss a number of results which seem to violate the notion of universality, at least as formulated in the naive version where the dimension, the spontaneously broken symmetry and the short-range nature of the interaction should imply the nature of the transition. We show in particular that various  $d$ -dimensional  $SO(n)$ -invariant ferromagnetic  $n$ -vector models with  $n$  and  $d$  at least 2 have first-order transitions in the temperature variable.

These models are nonlinear in the sense that the interaction is some function of the inner product between neighboring spin vectors which has the form of a deep and narrow well.

Similar results hold for liquid crystal models of Lebwohl-Lasher type and in lattice gauge models in  $d=3$  or more. Both the proof and the intuition behind it are based on a similarity with high-state Potts models.